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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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## **FULL CONTENTS**

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### **[Claim(s)]**

[Claim 1]A recycling method of waste rubber grinding waste rubber, obtaining vulcanization pulverization rubber, carrying out application-of-pressure vulcanization molding where this vulcanization pulverization rubber is surrounded by unvulcanized new rubber, and considering it as a reclaimed rubber cast.

[Claim 2]A recycling method of waste rubber, wherein said vulcanization pulverization rubber is non-diene system sulfur vulcanized gum in Claim 1 and said unvulcanized new rubber is diene system rubber.

[Claim 3]A reclaimed rubber cast characterized by coming to carry out application-of-pressure vulcanization molding where vulcanization pulverization rubber is surrounded by unvulcanized new rubber.

[Claim 4]A recycling method of waste rubber, wherein said vulcanization pulverization rubber is non-diene system sulfur vulcanized gum in Claim 1 and said unvulcanized new rubber is diene system rubber.

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### **[Detailed Description of the Invention]**

[0001]

[Industrial Application]This invention relates to the recycling method of the new abandonment rubber which waste rubber is efficient and can be used effectively. It is the suitable invention for autoparts, such as seal rubber parts, such as window frame rubber as which a surface physical property is especially required from sealing nature and the standpoint of appearance, a piston cup, a gasket, and a grommet, and a hose, and column covering.

[0002]Hereafter, the cable address of the rubber polymer used on these Descriptions is shown.

[0003]ACM [ -- Nitrile rubber NBR/PVC / -- Nitrile rubber / polyvinyl chloride mixed material SBR / -- Styrene butadiene rubber NR / -- Crude rubber ] -- Acrylic rubber CR -- Chloroprene rubber EPDM -- Amorphous ethylene propylene disconjugation Genta polymer NBR [0004]

[Description of the Prior Art]At the time of mold cure fabrication of rubber, a runner gate barricade etc. occur in addition to a cast, and waste rubber generates these so much. It is necessary to reuse such waste rubbers from the standpoint of saving resources (recycling).

[0005]As one of the recycling methods of waste rubber, waste rubber was ground, it was considered as vulcanization pulverization rubber (usually particle diameter of 500 micrometers or less), this vulcanization pulverization rubber and unvulcanized new rubber were kneaded, and it was reusing as a rubber composition for fabrication (usually sheet shaped).

[0006]

[Problem to be solved by the invention]However, when kneading and obtaining this rubber composition for fabrication, if there is much quantity of vulcanization pulverization rubber, a problem will occur in roll processability that it is easy to generate the float of a mixing roll (based on the high elasticity which the vulcanization pulverization rubber itself has). For this reason, 10% order was a limit and the amount of blends to the unvulcanized new rubber of vulcanization pulverization rubber (loadings) did not usually have the good reuse efficiency of waste rubber.

[0007]In view of the above, this invention can blend vulcanization pulverization rubber to unvulcanized new rubber so much, and an object of this invention is to provide the recycling method of the waste rubber which can raise the reuse efficiency of waste rubber.

[0008]Other purposes of this invention are to provide the recycling method of the waste rubber which reduction of the amount of the vulcanization system medicine used can plan on the occasion of complex use with new rubber and vulcanization pulverization rubber.

[0009]

[Means for solving problem]

(1) The recycling method of the waste rubber of this invention concerning Claim 1 solves above-mentioned SUBJECT by the following composition.

[0010]Waste rubber is ground, vulcanization pulverization rubber is obtained, where this vulcanization pulverization rubber is surrounded by unvulcanized new rubber, application-of-pressure vulcanization molding is carried out, and it is considered as a reclaimed rubber cast.

[0011](2) A recycling method of waste rubber of this invention concerning Claim 2 solves above-mentioned SUBJECT by the following composition.

[0012]In Claim 1, it is characterized by vulcanization pulverization rubber's being non-diene system sulfur vulcanized gum, and unvulcanized new rubber being diene system rubber.

[0013]

[Embodiment of the Invention]The recycling method of the waste rubber of this invention is explained in detail (refer to drawing 1).

[0014](1) First, grind waste rubbers (a sprue runner, a barricade, etc. which are generated from die forming), and obtain the vulcanization pulverization rubber 11.

[0015]The particle diameter of this vulcanization pulverization rubber shall usually be 0.001-1 mm (desirably 0.05-0.5 mm). When a pulverization art top is difficult and it exceeds 1 mm in less than 0.001 mm, it is easy to generate a problem in the coherence in the case of the below-mentioned application-of-pressure vulcanization molding, and the smooth nature of surface skin is also difficult to get.

[0016]The pulverization method of waste rubber is a conventional grinding means, and is performed with KATTAMIRU, a grinder roll, etc., for example.

[0017](2) Next, where this vulcanization pulverization rubber is surrounded by unvulcanized new rubber (new rubber), carry out application-of-pressure vulcanization molding, and consider it as a reclaimed rubber cast.

[0018]Here, as shown in drawing 1, the mode of surrounding of unvulcanized new rubber closes an end,

considers it as the shape of a bag (since it is in an unvulcanized state, it adheres), fills up with and closes the vulcanization pulverization rubber 13 to this bag-like object, and is performed in the tubed extrusion thing 11 of unvulcanized new rubber, for example. Vulcanization pulverization rubber may also be wrapped in the unvulcanized sheet \*\*\*\*(ed) and carried out like a Japanese wrapping cloth.

[0019]The thickness of unvulcanized new rubber in this case shall usually be 0.5-2 mm desirably 0.2-3 mm. In less than 0.2 mm, if it exceeds 3 mm for sufficient surface physical property (smooth nature) difficult to get, relatively, the rate of a compounding ratio of vulcanization pulverization rubber will become low, and will become difficult to play increase of the utilization efficiency of the waste rubber which is an effect of this invention.

[0020]Here, although combination of the rubber seed of vulcanization pulverization rubber and unvulcanized new rubber is made into rubber of the same kind, it may usually be different-species rubber. In the case of different-species rubber, unvulcanized new rubber is non-diene system sulfur vulcanized gum, and it is desirable for vulcanization pulverization rubber to be non-diene system sulfur vulcanized gum. or the polarity of unvulcanized new rubber -- the polarity of vulcanization pulverization rubber -- abbreviated -- an equivalent thing is desirable.

[0021]displaying the list of combination on Table 1 -- O: -- desirable -- \*:practical use is possible in combination (in both rubbers or new rubber with equivalent polarity, pulverization rubber is non-diene system sulfur vulcanized gum at diene system rubber) -- it combines and there is no chi:practicality -- combining (in new rubber, pulverization rubber is diene system rubber at non-diene system sulfur vulcanized gum) -- it carries out.

[0022]If unvulcanized new rubber is made into non-diene system rubber by making into diene system rubber vulcanization pulverization rubber which is an impractical combination, The shift phenomenon of the vulcanization system medicine from the vulcanization pulverization rubber by the side of unvulcanized new rubber not only does not arise, but even if it blends the vulcanization system medicine with unvulcanized new rubber, a vulcanization system medicine shifts to diene system rubber easily, and it is easy to generate poor vulcanization.

[0023]The amount of the vulcanization system medicine used of new rubber can be reduced by the positive shift by the side of the diene system rubber of the vulcanization medicine agent to which new rubber remains in vulcanized gum on the occasion of vulcanization molding when pulverization rubber is un-non-diene system vulcanized gum with diene system rubber.

[0024]As the method of application-of-pressure vulcanization molding, compression molding (refer to the example of a figure) and transfer molding can be used.

[0025]As an applicable rubber molding article, autoparts, such as seal rubber parts, such as window frame rubber, a piston cup, a gasket, and a grommet, and a hose, and column covering, etc. can be mentioned.

[0026]

[Function and Effect of the Invention]

(1), [ the recycling method of the waste rubber of this invention concerning Claim 1 ] Where it ground waste rubber, it obtained vulcanization pulverization rubber and this vulcanization pulverization rubber is surrounded by unvulcanized new rubber, Vulcanization adhesion (cocrosslinking) is carried out and the new rubber which serves as vulcanization pulverization rubber of which \*\* condensation was done, and a surface by composition carrying out application-of-pressure vulcanization molding, and considering it as a reclaimed rubber cast while both the powder of \*\* vulcanization pulverization rubber

condenses unifies.

[0027]Therefore, the reclaimed rubber cast which is seldom different from new rubber also finely [ surface skin ] and in physical properties can be obtained even if the ratio of vulcanization pulverization rubber is high.

[0028]Therefore, the method of reuse of the waste rubber of \*\*\*\*\* can blend vulcanization pulverization rubber to unvulcanized new rubber so much, and generates the effect which can raise the reuse efficiency of waste rubber.

[0029](2) , [ the recycling method of the waste rubber of this invention concerning Claim 2 ] [ by making said vulcanization pulverization rubber into non-diene system sulfur vulcanized gum (for example, EPDM), and making unvulcanized new rubber into diene system rubbers (for example NR, SBR, NBR, etc.) in Claim 1 ] The vulcanization system medicine (it has polarity) which remains in the non-diene system sulfur vulcanized gum which is vulcanization pulverization rubber shifts to the unvulcanized new rubber side which is diene system rubber positively, Even if it does not blend a vulcanization system medicine with new rubber, vulcanization of new rubber is performed, and in the interface of the pulverization vulcanized gum and new rubber which were condensed, vulcanization adhesion is performed simultaneously.

[0030]Therefore, it is not necessary to blend a vulcanization system medicine with new rubber, and submaterials combination manufacture of new rubber becomes easy.

[0031]the combination of different-species rubber -- the new rubber of a layer part -- a surface physical property -- the condensation pulverization vulcanized gum of a core part -- structural physical properties -- \*\*\*\*\* -- things are made and the application to the compound rubber molding article which has a function which the former has can also be expected.

[0032]

[Test Example(s)]Hereafter, the embodiment and comparative example which checks the effect of this invention and which was performed for accumulating are explained. Especially a combination unit is a unit of weight, unless it refuses.

[0033]Each compounded rubber prescription of EPDM and NBR used for each example of an examination is as follows.

[0034]

57C100 copies of EPDM combination prescription JSR EP (EPDM by Japan Synthetic Rubber Co., Ltd.)

Flower of zinc [ No. 3 ] five copies Stearic acid One copy 150 copies of carbon black FEF Lime stone powder 70 copies Paraffine system processing oil 130 copies Two copies of vulcanization accelerators TMTD One copy of vulcanization accelerator MBT The sulfur two-copy NBR combination prescription JSR. N230 100 copies (NBR by Japan Synthetic Rubber Co., Ltd.)

Flower of zinc [ No. 3 ] five copies Stearic acid Two copies 150 copies of carbon black SRF 50 copies of precipitated calcium carbonate light 50-copy DOP(s) Two copies of vulcanization accelerators TMTD One copy of vulcanization accelerator CBS With the compression molding from the rubber compound of sulfur one-copy <example 1 of examination> above-mentioned each combination prescription. Each vulcanization pulverization rubber with an average particle diameter of 0.4 mm was obtained having applied to KATTAMIRU each vulcanized gum which carried out application-of-pressure vulcanization molding (170 \*\*x 10-minute x10MPa).

[0035][ and the thing which carried out extrusion molding of each new rubber of each above-mentioned

combination prescription to hollow shape (outside-diameter / of 15 mm / x thickness of 1 mm), judged it, closed the end, and was made into the shape of a bag ] After filling up and closing so that it may become weight % which shows each vulcanization pulverization rubber of the same prescription in Tables 2 and 3, respectively, the cast of 150 mm\*\*x3mmt was obtained by compression molding (170 \*\*x 10-minute x10MPa) performing application-of-pressure vulcanization molding.

[0036]Also about what kneaded the unvulcanized new rubber of each combination prescription as the examples 1 and 2 of reference, and kneaded the vulcanization pulverization rubber of the same prescription to unvulcanized new rubber as the comparative examples 1 and 2 (10% was a limit practically.), application-of-pressure vulcanization molding was performed similarly, and the rubber molding article was obtained.

[0037]While doing each physical-properties examination of the display about each rubber molding article based on JIS K 6301, surface relative roughness was measured based on JIS B 0601.

[0038]Even if Table 2 (EPDM/EPDM) and 3 (NBR/NBR) to this invention which shows these results blends pulverization vulcanized gum with a large quantity (not less than 50%), while the surface physical property which is not inferior even if it surpasses the cast of only new rubber is shown, it turns out that the original-state physical properties which hardly change are shown.

[0039]In the example 1 of the <example 2 of examination> examination, combination of new rubber and vulcanization pulverization rubber is made into different species, and the amount of blends is made into an equivalent amount (50% of the amount of vulcanization pulverization rubber compounding). In that case, what removed a vulcanization accelerator and sulfur was used for new rubber.

[0040]In the case of the combination which set unvulcanized new rubber to NBR, as the vulcanization pulverization rubber EPDM, the beautiful cast in which the NBR layer by the side of the surface was also vulcanized enough was obtained. The result of the physical-properties examination was as follows.

[0041]hardness (JIS-A): -- 71 and tensile-strength (MPa):11.0 -- it being extended, and vulcanization pulverization rubber being set to NBR and, (%):350, surface relative roughness (Rz):6, however when reverse, [ rubber ] In the case of the combination which set unvulcanized new rubber to EPDM, measurement of various physical properties which poor vulcanization generated (stickiness is the remainder) was not completed in the EPDM layer by the side of the surface.

[0042]

[Table 1]

新ゴム 粉碎ゴム	EPDM (イオウ)	EPDM (P/O)	NR	SBR	CR	ACM	NBR	NBR /PVC
EPDM (イオウ)	○	○	×	×	×	△	×	×
EPDM (P/O)	○	○	○	○	△	△	△	△
NR	○	○	○	○	△	△	△	△
SBR	○	○	○	○	○	△	△	△
CR	○	△	△	○	○	○	○	○
ACM	△	△	△	△	○	○	○	○
NBR	○	△	△	△	○	○	○	○
NBR /PVC	○	△	△	△	○	○	○	○

[0043]

[Table 2]

## EPDM / EPDM

	参照例 1	比較例 1	実 施 例				
	1	2	3	4	5		
粉末ゴム ブレンド量	0wt%	10wt%	10wt%	30wt%	50wt%	70wt%	90wt%
物 性 硬 さ (JIS A)	62	63	61	61	63	62	61
引張強度 (MPa)	10.5	9.6	10.3	9.6	9.1	8.4	7.7
伸 び (%)	320	320	320	320	320	310	300
表面粗度 (Rz)	9 μm	13 μm	8 μm	9 μm	8 μm	10 μm	10 μm

[0044]

[Table 3]

## NBR/NBR

	参照例 2	比較例 2	実 施 例				
	6	7	8	9	10		
粉末ゴム ブレンド量	0wt%	10wt%	10wt%	30wt%	50wt%	70wt%	90wt%
物 性 硬 さ (JIS A)	7 3	7 2	7 3	7 4	7 3	7 3	7 4
引張強度 (MPa)	1 3 . 2	1 2 . 0	1 2 . 6	1 2 . 1	1 1 . 7	1 0 . 9	1 0 . 3
伸 び (%)	3 5 0	3 4 0	3 5 0	3 4 0	3 3 0	3 3 0	3 1 0
表面粗度 (R <sub>z</sub> )	6 μm	8 μm	6 μm	6 μm	6 μm	8 μm	7 μm

[Brief Description of the Drawings]

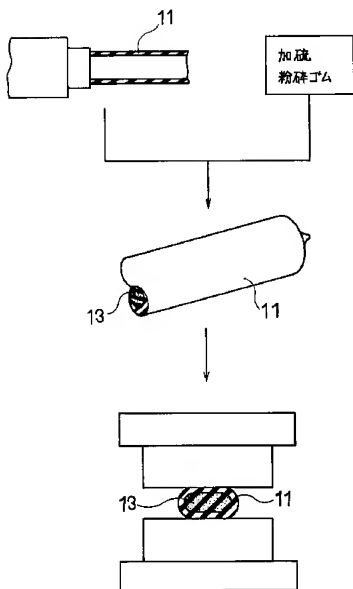
[Drawing 1] The process schematic diagram showing the method of this invention.

[Explanations of letters or numerals]

11 -- Tubed extrusion thing (unvulcanized new rubber),

13 -- Vulcanization pulverization rubber,

[Drawing 1]



[Translation done.]